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## Electric Power System Specification

### Project Name:

Calera - Generator

### Accepting Authority:

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Superintendent  
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### Presented By:

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### Bid Due Date:

(Date)

### Specification Development Date:

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## 1. GENERAL

### 1.1. DESCRIPTION OF SYSTEM

1.1.1. Provide a standby power system to supply electrical power in event of failure of normal supply, consisting of a liquid cooled engine, an AC alternator and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

### 1.2. REQUIREMENTS OF REGULATORY AGENCIES

1.2.1. An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

1.2.2. The generator set(s) must conform to applicable NFPA standards.

1.2.3. The generator set(s) must be available with the Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.

1.2.4. The transfer switch(es) must be UL listed for use in emergency systems.

1.2.5. The generator set(s) must meet EPA federal emission guidelines for stationary standby power generation.

### 1.3. MANUFACTURER QUALIFICATIONS

1.3.1. This system shall be supplied by Generac Power Systems® or an approved equal who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of twenty years, thereby identifying one source of supply and responsibility.

1.3.2. To be classified as a manufacturer, the builder of the generator set must manufacture, at minimum, engines or alternators.

1.3.3. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.

## 2. ENGINE-GENERATOR SET

## 2.1. Engine

2.1.1. The prime mover shall be a liquid cooled, natural gas fueled, naturally aspirated engine of 4-cycle design. It will have 10 cylinders with a minimum displacement of 6.8 liters (417 cubic inches), with a minimum rating of 224 BHP. The unit requires a minimum rated output of 150 kw at an operating speed of 3600 RPM.

2.1.2. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 122 degrees f, 50 degrees c ambient temperature.

2.1.3. The intake air filter(s) with replaceable element must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s). Engine coolant and oil drain extensions, equipped with pipe plugs, must be provided to outside of the mounting base for cleaner and more convenient engine servicing. A fan guard must be installed for personnel safety.

2.1.4. The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a solenoid shift, electric starter.

2.1.5. The engine fuel system shall be designed for primary operation on natural gas having a BTU content of 1000 BTU per cubic foot delivered to the unit in a vapor state. A carburetor, secondary regulator, fuel lock-off solenoid and all piping must be installed at the point of manufacturing, terminating at a single pipe opening external to the mounting base.

2.1.6. The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer. The contractor shall provide proper branch circuit from normal utility power source.

2.1.7. Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, overspeed shutdown and overcrank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, each sensor connection shall be sealed to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.

2.1.8. Provide the following items installed at the factory:

2.1.8.1. The manufacturer shall supply a catalytic muffler and air/fuel ratio controller. The catalytic muffler must be part of the engine exhaust system and completely installed and tested at the factory.

2.1.8.2. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system.

2.1.9. The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the unit:

2.1.9.1. The manufacturer will supply its recommended flexible fuel line to connect the engine to the external natural gas fuel supply line. On stationary applications the fuel line shall match the fuel fitting on the unit and have braided stainless steel covering with brass fittings.

2.1.10. Engine speed shall be controlled by isochronous governor with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2.1.11. One step load acceptance shall be 100% of engine-generator set nameplate rating and meet the requirements of NFPA 110 paragraph 7.13.7

2.1.12. The generator system shall support generator start-up and load transfer within 10 seconds.

## 2.2. ALTERNATOR

2.2.1. The alternator shall be a 4 pole revolving field type, 12 lead, wired for 120/208 vac 3 phase, 60 hz, rated at 150 kw with a permanent magnet driven exciter. Photosensitive components will not be permitted in the rotating exciter. The stator shall be gear drive connected to the engine to ensure permanent alignment. The generator shall meet temperature rise standards for Class "H" insulation, operate within Class "F" standards for extended life. All leads must be extended into an AC connection panel. The alternator shall be protected by internal thermal overload protection and an automatic reset field circuit breaker.

2.2.2. One step load acceptance shall be 100% of engine-generator set nameplate rating and meet the requirements of NFPA 110 paragraph 5-13.2.6. The generator set and regulator must sustain at least 300%



short circuit current for 10 seconds during 3 phase fault.

2.2.3. A NEMA 1 panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. An fully rated, isolated neutral must be included by the generator set manufacturer to insure proper sizing.

2.2.4. The electric plant (engine and alternator) shall be mounted with internal vibration isolation onto a welded steel base. External vibration isolation shall not be required for normal pad mounted applications.

2.2.5. Provide the following items installed at the factory:

2.2.5.1. A main line circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated per the manufacturer's recommendations. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections. A system utilizing manual reset field circuit breakers and current transformers is unacceptable.

### 2.3. CONTROLS

2.3.1. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.

2.3.2. The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic management system if so equipped. Generator controller's that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.

2.3.3. Communications shall be supported with building automation via the Modbus protocol without network cards or protocol exchangers. Optional internet and intranet connectivity shall be available.

2.3.4. The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

2.3.5. Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

2.3.6. A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.

2.3.7. Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .1msec data logging capabilities.

2.3.8. The control system shall provide pre-wired customer use I/O: 4 contact inputs, 2 analog inputs, 4 relay outputs, and communications support via RS232, RS485, and an optional modem. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

2.3.9. The control panel will display all user pertinent unit parameters including:

- Engine and alternator operating conditions
- Oil pressure and optional oil temperature
- Coolant temperature and level alarm
- Fuel level (where applicable)
- Engine speed
- DC battery voltage
- Run time hours
- Generator voltages, amps, frequency, kilowatts, and power factor
- Alarm Status
- Current alarm(s) condition per NFPA 110 level 1
- Alarm Log of last twenty alarm events (date and time stamped)

2.3.10. For system reliability and security concerns, access to and manipulation of the internal operating parameters and alarm limits shall be conducted via password protected PC based software by trained

personnel System configuration support shall be provided locally or remotely by the manufacturers servicing representatives.

2.3.11. The following equipment is to be installed at the engine-generator set manufacturer's facility:

2.3.11.1. A 100 dbA alarm horn operated on 12 VDC through the generator common alarm relay shall be supplied by the engine/generator manufacturer.

### **3. AUTOMATIC TRANSFER SWITCH**

#### **3.1. GENERAL**

3.1.1. The automatic transfer switch shall be furnished by the manufacturer of the engine-generator set so as to maintain system compatibility and local service responsibility for the complete emergency power system. It shall be listed by Underwriter's Laboratory, Standard 1008 with fuse or circuit breaker protection. Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically operated transfer from normal to emergency and back to normal. Wiring must comply with NEC table 312.6. The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.

#### **3.2. RATINGS & PERFORMANCE**

3.2.1. The automatic transfer switch shall be a 3 pole design rated for 600 amps continuous operation in ambient temperatures of -20 degrees Fahrenheit (-30 degrees Celsius) to +140 degrees Fahrenheit (+60 degrees Celsius). Main power switch contacts shall be rated for 600 V AC minimum. The transfer switch supplied shall have a minimum withstand and closing rating when fuse protected of 200,000 amperes. Where the line side overcurrent protection is provided by circuit breakers, the short circuit withstand and closing ratings shall be 42,000 amperes RMS. These RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch. All withstand tests shall be performed with the overcurrent protective devices located external to the transfer switch.

#### **3.3. CONSTRUCTION**

3.3.1. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy with arc chutes and separate arcing contacts to resist burning and pitting for long life operation.

#### **3.4. CONTROLS**

3.4.1. Retransfer the load to the line after normal power restoration. A return to utility timer, adjustable from 1-30 minutes, shall delay this transfer to avoid short term normal power restoration.

3.4.2. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.

3.4.3. Provide an engine minimum run timer, adjustable from 5-30 minutes, to ensure an adequate engine run period.

3.4.4. Provide manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.

3.4.5. Provide a maintenance disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.

#### **3.5. MISCELLANEOUS TRANSFER SWITCH EQUIPMENT**

### **4. ADDITIONAL UNIT REQUIREMENTS**

#### **4.1. Unit Accessories**

4.1.1. The following equipment is to be installed at the engine-generator set manufacturer's facility:

4.1.1.1. 6.8L weather protective enclosure: The engine-generator set shall be factory enclosed in a heavy gauge steel enclosure constructed with 14 gauge corner posts, uprights and headers. The roof shall be





made of aluminum, aid in the runoff of water and include a drip edge. The enclosure shall be coated with electrostatically applied powder paint, baked and finished to manufacturers specifications. The color will be tan-standard. The enclosure is to have large, hinged doors to allow access to the engine, alternator and control panel. The doors must lift off without the use of tools. Each door will have lockable hardware with identical keys. Padlocks do not meet this specification.

The exhaust silencer(s) shall be provided of the size as recommended by the manufacturer and shall be of critical grade. The silencer(s) shall be mounted within the weather protective enclosure for reduced exhaust noise and provide a clean, smooth exterior design. It shall be connected to the engine with a flexible, seamless, stainless steel exhaust connection. A rain cap will terminate the exhaust pipe. All components must be properly sized to assure operation without excessive back pressure when installed.

4.1.1.2. A heavy duty, lead acid 12vdc battery set rated at 700 CCA, BCI group 27F shall be installed by the generator set manufacturer. Provide all intercell and connecting battery cables as required.

4.1.1.3. Provide an automatic dual rate battery charger. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The output voltage is to be determined by the charge current rate. The charger must be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

## **5. ADDITIONAL PROJECT REQUIREMENTS**

### **5.1. APPLIED STANDARDS**

5.1.1. The generator set(s) must be manufactured to the applicable specifications on file with Underwriters Laboratories and the UL 2200 mark must be affixed.

5.1.2. The transfer switch(es) must be UL listed and carry the UL mark for use in emergency systems.

### **5.2. FACTORY TESTING**

5.2.1. Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

5.2.1.1. Verifying all safety shutdowns are functioning properly.

5.2.1.2. Verify single step load pick-up per NFPA 110-1996, Paragraph 5-13.2.6.

5.2.1.3. Verify transient and voltage dip responses and steady state voltage and speed (frequency) checks.

5.2.2. Before shipment of the transfer switch shall be tested under operating conditions for performance and proper functioning of control and interfacing circuits. Tests shall include:

5.2.2.1. Verify all timing sequences operate properly and are set to factory settings.

5.2.2.2. Verify the transfer mechanism operates properly.

5.2.2.3. Verify all manual operations and indicators are functioning properly.

### **5.3. OWNER'S MANUALS**

5.3.1. Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

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### **5.4. INSTALLATION**

5.4.1. Contractor shall install the complete electrical generating system including all fuel connections in accordance with the manufacturer's recommendations as reviewed by the Engineer.

### **5.5. SERVICE**

5.5.1. Supplier of the electric plant and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

## 5.6. WARRANTY

5.6.1. The standby electric generating system components, complete engine-generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five (5) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.

The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

## 5.7. STARTUP AND CHECKOUT

5.7.1. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:

5.7.1.1. Ensuring the engine starts (both hot and cold) within the specified time.

5.7.1.2. Verification of engine parameters within specification.

5.7.1.3. Verify no load frequency and voltage, adjusting if required.

5.7.1.4. Test all automatic shutdowns of the engine-generator.

5.7.1.5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

## 5.8. SUBMITTALS

5.8.1. Provide three complete sets of Engineering Submittal for approval, prior to production release, showing all components, in addition to the engine and generator. Submittals shall include compliance with these specifications.

## 5.9. SUBSTITUTIONS

5.9.1. The emergency power system has been designed to the specified manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around Generac Power System's equipment. Should any substitutions be made, the contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs which may result from such substitutions. Alternate equipment suppliers shall furnish equipment submittals 14 days prior to bid date for approval to bid. As part of the submittals, the substitute manufacturer shall supply as a minimum engine, alternator and control panel wiring diagrams and schematics. A separate list of all printed circuit boards with part numbers and current pricing must also be included.

GENERAC QT150 OR EQUAL